

CLAIMS

1. A frequency control apparatus which observes an operation state of a control object and controls an operation frequency of the control object, comprising:

5 frequency determination means for determining the operation frequency in response to the operation state of the control object; and

frequency limitation means for limiting a range or a value of the operation frequency determined by said frequency determination means.

10 2. A frequency control apparatus according to claim 1, further comprising means for discriminating whether or not a frequency of a clock signal supplied to the control object to define the operation frequency of the control object is within a prescribed or designated frequency range or has a prescribed or designated frequency value, said frequency limitation means limiting the frequency of the clock signal to a frequency within the frequency range or to the frequency value when it is discriminated that the frequency of the clock signal is not within
15 the frequency range or does not have the frequency value.

3. A frequency control apparatus according to claim 2, wherein said frequency limitation means includes threshold value setting means for setting a threshold value of an upper limit or a lower limit to the frequency of the clock signal.

20

4. A frequency control apparatus according to claim 3, wherein said threshold value setting means includes a frequency setting register having the threshold value which can be changed dynamically through execution of a program.

25 5. A frequency control apparatus according to claim 3, wherein said threshold value setting means sets threshold values of an upper limit and a lower limit to the frequency of the clock signal simultaneously to limit a frequency width of the clock signal.

30 6. A frequency control apparatus according to claim 5, wherein said threshold value setting means sets the threshold values of the upper limit and the lower limit to an equal value so that

the frequency of the clock signal is limited to the fixed value.

7. A frequency control apparatus according to claim 2, wherein said frequency limitation means includes frequency designation means for designating the frequency of the clock signal.

5

8. A frequency control apparatus according to claim 1, wherein said frequency determination means observes the operation state of the control object after every fixed interval of time and determines the operation frequency based on the observed operation state.

10 9. A frequency control apparatus according to claim 1, wherein the control object is a device for an arithmetic operation process which operates with a frequency selectively set among a plurality of clock frequencies.

15 10. A frequency control apparatus according to claim 3, further comprising frequency management means for receiving, from each of operating programs, a notification of required information regarding the frequency of the clock signal suitable for the operation of the program and managing the information from the programs in a unified manner, said threshold value setting means setting the frequency range or the frequency value for the clock signal in accordance with a setting instruction of said frequency management means.

20

11. A frequency control apparatus according to claim 10, wherein, when said frequency management means receives, from each of the operating programs, a notification of required information including a lower limit frequency value or an upper limit frequency value regarding the frequency of the clock signal, said frequency management means adopts the highest
25 frequency value in the information of the received notifications to determine the frequency range or the frequency value for the clock signal.

12. A frequency control apparatus according to claim 10, wherein, when said frequency management means receives, from each of the operating programs, a notification of required
30 information including a lower limit frequency value or an upper limit frequency value regarding

the frequency of the clock signal, said frequency management means adds the frequency values in the information of the received notifications and adopts a frequency value equal to the sum value to determine the frequency range or the frequency value for the clock signal.

5 13. A frequency control apparatus according to claim 10, wherein, when said frequency management means receives a notification of an end of one of the programs when the program comes to an end, said frequency management means determines the frequency range or the frequency value for the clock signal based on required information including a lower limit frequency value or an upper limit frequency value regarding the frequency of the clock signal
10 from each of the other operating programs.

14. A frequency control apparatus according to claim 10, wherein frequencies of the clock signal required by processes or threads regarding the programs are registered in advance in said frequency management means, and said frequency management means calculates an added total
15 value of the frequencies of all of the processes or threads of the operating programs and performs frequency setting based on the added total value before a process or a thread of any of the operating programs is activated, and when the activated process or thread comes to an end, said frequency management means immediately subtracts the frequency of the process or thread from the added total value.

20

15. An information processing apparatus for controlling a frequency of a clock signal to be supplied to an object device which operates with a frequency variably set at any time, comprising:

means for observing an operation state of the object device;

25 frequency determination means for determining the frequency in response to the operation state of the object device; and

frequency limitation means for limiting a range or a value of the frequency determined by said frequency determination means.

30 16. An information processing apparatus according to claim 15, further comprising means for

discriminating whether or not a frequency of a clock signal supplied to the object device is within a prescribed or designated frequency range or has a prescribed or designated frequency value, said frequency limitation means limiting the frequency of the clock signal to a frequency within the frequency range or to the frequency value when it is discriminated that the frequency
5 of the clock signal is not within the frequency range or does not have the frequency value.

17. An information processing apparatus according to claim 16, wherein said frequency limitation means includes threshold value setting means for setting a threshold value of an upper limit or a lower limit to the frequency of the clock signal.
10

18. An information processing apparatus according to claim 17, wherein said threshold value setting means includes a frequency setting register having the threshold value which can be changed dynamically through execution of a program.

15 19. An information processing apparatus according to claim 18, wherein said threshold value setting means sets threshold values of an upper limit and a lower limit to the frequency of the clock signal simultaneously to limit a frequency width of the clock signal.

20. An information processing apparatus according to claim 19, wherein said threshold value setting means sets the threshold values of the upper limit and the lower limit to an equal value so
20 that the frequency of the clock signal is limited to the fixed value.

21. An information processing apparatus according to claim 16, wherein said frequency limitation means includes frequency designation means for designating the frequency of the
25 clock signal.

22. An information processing apparatus according to claim 15, wherein said frequency determination means observes the operation state of the object device after every fixed interval of time and determines the frequency based on the observed operation state.
30

23. An information processing apparatus according to claim 15, wherein the object device is a device for an arithmetic operation process.

24. An information processing apparatus according to claim 18, further comprising frequency management means for receiving, from each of operating programs, a notification of required information regarding the frequency of the clock signal suitable for the operation of the program and managing the information from the programs in a unified manner, said threshold value setting means setting the frequency range or the frequency value for the clock signal in accordance with a setting instruction of said frequency management means.

10

25. An information processing apparatus according to claim 24, wherein, when said frequency management means receives, from each of the operating programs, a notification of required information including a lower limit frequency value or an upper limit frequency value regarding the frequency of the clock signal, said frequency management means adopts the highest frequency value in the information of the received notifications to determine the frequency range or the frequency value for the clock signal.

15

26. An information processing apparatus according to claim 24, wherein, when said frequency management means receives, from each of the operating programs, a notification of required information including a lower limit frequency value or an upper limit frequency value regarding the frequency of the clock signal, said frequency management means adds the frequency values in the information of the received notifications and adopts a frequency value equal to the sum value to determine the frequency range or the frequency value for the clock signal.

20

27. An information processing apparatus according to claim 24, wherein, when said frequency management means receives a notification of an end of one of the programs when the program comes to an end, said frequency management means determines the frequency range or the frequency value for the clock signal based on required information including a lower limit frequency value or an upper limit frequency value regarding the frequency of the clock signal from each of the other operating programs.

25

30

28. An information processing apparatus according to claim 26, wherein frequencies of the clock signal required by processes or threads regarding the programs are registered in advance in said frequency management means, and said frequency management means calculates an added total value of the frequencies of all of the processes or threads of the operating programs and performs frequency setting based on the added total value before a process or a thread of any of the operating programs is activated, and when the activated process or thread comes to an end, said frequency management means immediately subtracts the frequency of the process or thread from the added total value.

10

29. A program which is used to function in an apparatus for observing an operation state of a control object to control an operation frequency of the control object, comprising:

a step of setting, upon or after activation of the program, a limitation value for limiting the operation frequency in accordance with a characteristic of a load or an accuracy in processing.

15

30. A program according to claim 29, further comprising a step of canceling the setting relating to or resetting the limitation to the operation frequency performed upon or after the activation.

20